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Subject: STS 116 Return Samples: Assessment of Air Quality aboard the Shuttle (STS-116) and International Space Station (12A.1)  
Date: April 2, 2007

The toxicological assessments of 2 grab sample canisters (GSCs) from the Shuttle are reported in Table 1. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (<sup>13</sup>C-acetone, fluorobenzene, and chlorobenzene) from the 2 GSCs averaged 105, 102, and 106 %, respectively. The Shuttle atmosphere was acceptable for human respiration.

Table 1. Analytical Summary of Shuttle Samples

Sample Location	Date of Sample	NMVOCs <sup>1</sup> (mg/m <sup>3</sup> )	T Value <sup>2</sup> (units)	Alcohols (mg/m <sup>3</sup> )	Formaldehyde (ug/m <sup>3</sup> )
Middeck (preflight)	12/09/06	1.3	0.47	0.2	--
Middeck (end mission)	12/22/06	18	0.55	0.7	--

<sup>1</sup> Non-methane volatile organic hydrocarbons.

<sup>2</sup> Calculated excluding CO<sub>2</sub>, formaldehyde, and siloxanes. High value for preflight sample due to a trace of propenal.

The toxicological assessment of 10 GSCs and 24 formaldehyde badges from the ISS is shown in Table 2. The recoveries of the 3 standards (as listed above) from the GSCs averaged 91, 97 and 101%. Four formaldehyde control badges averaged 88% recovery.

Table 2. Analytical Summary of ISS Results

Module/Sample	Approx. Date	NMVOCs <sup>1</sup> (mg/m <sup>3</sup> )	T Value <sup>2</sup> (units)	Alcohols (mg/m <sup>3</sup> )	Formaldehyde (ug/m <sup>3</sup> )
Lab/Formal.	7/28/06	--	--	--	37
SM/Formal.	7/28/06	--	--	--	29
Lab/Formal.	8/14/06	--	--	--	39
SM/Formal.	8/14/06	--	--	--	33
Lab/GSC/Formal.	9/18-25/06	16	0.77	3.4	18
FGB/GSC	9/18/06	12	0.69	3.1	--
SM/GSC/Formal.	9/18-25/06	8	0.69	3.2	18
SM/GSC-Conting.	9/18/06	16	3.23 <sup>3</sup>	3.4	--
Lab/Formal.	10/25/06	--	--	--	32
SM/Formal	10/25/06	--	--	--	24
Lab/GSC/Formal.	11/14/06	11	1.60 <sup>4</sup>	3.7	37
FGB/GSC	11/14/06	8	0.69	3.5	--
SM/GSC/Formal.	11/14/06	11	0.70	3.5	29
Lab/GSC/Formal.	12/07/06	8	0.68	3.8	39
FGB/GSC	12/07/06	9	0.71	3.8	--
SM/GSC/Formal.	12/07/06	10	0.92	4.3	32
Guideline		<25	<1.0	<5	<120

<sup>1</sup> Non-methane volatile organic hydrocarbons.

<sup>2</sup> Calculated excluding CO<sub>2</sub>, formaldehyde, and siloxanes.

<sup>3</sup> Primary component that increased the T value was benzene (T=2.50).

<sup>4</sup> Primary component that increased the T value was propenal (T=0.80).

The ISS atmosphere was found to be acceptable for human respiration. The alcohols were below the threshold established for protection of the water recovery system.

Formaldehyde badges continue to show that the SM has a slightly lower concentration of formaldehyde than the Lab, but both modules are well below the guideline level.

There was a report of an air quality issue during the attempted repair of the Elektron oxygen generator. At 2006/261:11:01 (9/18/06) the secondary purification unit became extremely hot and generated smoke. Sometime later when a valve was opened the crew detected a “gasoline-like” synthetic odor. Crew symptoms were not reported from this incident; however, a GSC taken in the SM approximately 2 ½ hours later showed a T value of 3.23 units, mostly due to benzene. Other aromatic compounds (toluene, ethylbenzene, and xylenes) were increased in this sample. At this time the odor seemed to be reduced from earlier levels. A sample taken in the SM 5 minutes before the Elektron accident showed nominal levels of air pollution (T=0.69).

#### Enclosures

[Table 1A: Analytical concentrations of compounds found in the STS-116 GSCs](#)

[Table 1B: Analytical concentrations of compounds found in 12A.1 GSCs](#)

[Table 2A: T-values of the compounds in table 1A](#)

[Table 2B: T-values of the compounds in table 1B](#)